

Mapping of Digital Commons in Sub-Saharan Africa

Agence Française de Développement (AFD)



Babylab Ivory Coast

Author: Jan Krewer, independent consultant.

Editors : Stéphanie Leyronas, Lola Mercier, Jean Millerat, Gwenaël Prié of the Agence Française de Développement (AFD).

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Introduction

Agence Française de Développement (AFD) has chosen to make digital commons a lever of its Digital Transition strategy (2021-2025). Digital commons allow citizens to contribute directly to the creation and management of the digital resources they need. Digital commons are already present in the daily lives of thousands of Africans, in the field of collaborative cartography (OSM), software publishing for public health services or community Internet access networks.

In order to determine how to support these communities, AFD has launched a mapping of digital commons in Sub-Saharan Africa. The objective is to better understand these resources, their importance, and the functioning of their communities. AFD wanted to involve as many experts and practitioners as possible in this mapping, the results of which are made public and available to other actors.

Growing international interest in public goods and the digital commons

This mapping exercise takes place in the context of **a growing interest of international organizations and states in open resources, public goods, or the digital commons**. The United Nations Educational, Scientific and Cultural Organization (UNESCO) launched a working group on public domain information in 2001¹ and more recently launched a dynamic coalition on open educational resources². For the OECD, these open resources are also a catalyst for innovation³. In 2020, an international alliance for digital public goods was created, following up on a recommendation in the UN Secretary General's Roadmap for Digital Cooperation⁴. The Alliance now includes the German Federal Ministry for Economic Cooperation and Development (BMZ), the Government of Sierra Leone, the Norwegian Agency for Development Cooperation (NORAD), the United Nations Development Programme, and the United Nations Children's Fund (UNICEF). The United Nations Conference on Trade and Development (UNCTAD), in its latest report on the digital economy, refers to the "data commons" as a means of organizing a more inclusive and equitable digital economy⁵.

¹ For UNESCO, the "public domain of information or 'global information commons' consists of freely accessible information, intellectual works or the media on which they are stored, the use of which does not infringe any intellectual property right, violate any other community right (e.g., the rights of indigenous peoples), or violate any obligation of confidentiality." See Draft Policy Guidelines for the Development and Promotion of Public Domain Information, UNESCO, Paris, 2003: https://unesdoc.unesco.org/ark:/48223/pf0000129725_fre.locale=fr

² The Dynamic Coalition for Open Educational Resources (OER), UNESCO: <https://fr.unesco.org/themes/building-knowledge-societies/oer/dynamic-coalition>

³ Orr, D., M. Rimini and D. van Damme (2015), Open Educational Resources: A Catalyst for Innovation, Educational Research and Innovation, OECD Publishing, Paris, <https://doi.org/10.1787/9789264247543-en>

⁴ For the UN Secretary-General, digital public goods are "open source software, open data, open artificial intelligence models, open standards and open content that respect privacy, applicable laws and good practices, do no harm by design and contribute to the achievement of the SDGs." <https://www.un.org/fr/content/digital-cooperation-roadmap/>

⁵ For UNCTAD, "given the multiplicity of actors involved as sources of data and/or affected by their use, data management must be considered in a way that contributes to development. It is a question of reinventing data governance to put it at the service of populations and the planet. New models of data governance are thus emerging, involving various actors and allowing them to share their data in order to increase its social value." https://unctad.org/system/files/official-document/der2021_fr.pdf

Although the terms used by these organizations may differ, **they agree on the potential for sustainable development offered by access to digital resources, guaranteed by the use of free licenses⁶**. They also agree on the growing need for States to share responsibility for the protection and management of these resources, which makes it possible to pool skills for the modernization of public services⁷, to strengthen cybersecurity and digital sovereignty⁸, or to participate in the development of alternative models to the centralization of the digital economy⁹. This orientation also responds to a growing interest on the part of African states, since the African Union, in its digital transformation strategy, refers to free educational resources, open data, open access to research results, and the use of open standards to promote interoperability at the continental level, particularly for public digital services, such as digital identity¹⁰.

Terms used	Open Resources	Digital Public Goods	Digital Commons
Most frequently associated impacts in the literature consulted	Free flow of information and knowledge transparency, support for innovation	Pooling of resources, efficiency, participation in sustainable development goals, international cooperation	Capacity building through contribution, distribution of value creation, development of alternative structures to the centralization of the digital economy

Studying local embodiments of these resources in sub-Saharan Africa

The attention given in this mapping to the commons and to a specific geographical area - sub-Saharan Africa - should complement this observation. Indeed, it should allow us to study the local incarnations of this movement, by studying the communities of users and contributors and their participation in the governance of these resources. AFD is particularly interested in the organizational forms that allow for the reinvention of forms of contribution and participation of citizens in cultural, social and economic life.

Sub-Saharan Africa is a priority for AFD: it remains the geographic area where AFD has the most financial resources to support its public and private partners, since 50% of AFD's

⁶ Free licenses allow an author to give free permission, to all and in advance, to use his work under the conditions set out in the license. <https://www.economie.gouv.fr/apie/propriete-intellectuelle-publications/contenus-sous-licences-libres>

⁷ See the series of articles on public digital assets by Richard Pope, a member of the founding team of the UK Government Digital Service: <https://digitalpublicgoods.xyz/>

⁸ Conference "Building Europe's Digital Sovereignty", held in Paris on February 7 and 8 <https://www.economie.gouv.fr/conference-pfue-souverainete-numerique>

⁹ Verdier, Henri, and Charles Murciano. "The digital commons, the foundation of a new political economy," *Esprit*, vol., no. 5, 2017, pp. 132-145. <https://www.cairn.info/revue-esprit-2017-5-page-132.htm?contenu=plan>

¹⁰ The African Union Commission's digital transformation strategy: https://au.int/sites/default/files/documents/38507-doc-dts_-_french.pdf

activity directly concerns Africa. But while the needs are great, Sub-Saharan Africa is also an area where the development opportunities offered by digital technology are widely recognized, particularly in East Africa. AFD is already heavily involved in supporting the digital transition on the continent and would like to be able to develop the knowledge that is still under construction on the digital commons in this context.

From open resources to the digital commons: differing development impacts

In the context of this work, the definition of the commons used is in line with the work of the economist Elinor Ostrom. **A commons is thus made up of three inseparable elements: a resource, a set of actors with rights over it, and a set of rules developed by this community to regulate its use according to the evolution of the ecological, social and economic context.** The commons are distinguished by a governance defined by the community - as opposed to governance by the State or the market, or by a form of self-management that opposes hierarchy or prices as coordination mechanisms. The rules of use are not defined a priori - they may vary with the commons and their specific contexts.

Adopting this definition should make it possible **to observe the social dynamics at work - the processes of learning, reappropriation, or value creation at the local level, rather than focusing solely on technical solutions.** While it will not allow us to draw a clear line between resources whose governance may be more or less contributory, it should make it possible to highlight the difference in impact of one approach compared to another. Thus, it is not a matter of disqualifying or neglecting the positive impact of greater international availability of software source code, for example, or of the widespread use of free licenses for the publication of publicly funded content. Explicit support for the commons, i.e. for more decentralized and contributory modes of governance, nevertheless seems to offer additional potential for capacity building and value creation at the local level.

Methodology

The objective of this mapping is the identification of digital commons in Sub-Saharan Africa. It therefore concerns :

- The **commons is defined as a resource** around which **a community of contributors and users** gathers, and which has **rules for contribution and use**.
- **Digital** commons (code, information, content, hardware, etc.) - excluded from this study are non-digital communities or commons that would only mobilize digital for their functioning.
- Digital commons that have communities of users and/or contributors **in Sub-Saharan Africa**.

The mapping of these digital commons was done mostly by the author and supplemented by external submissions via an online form, as well as recommendations obtained during a series of interviews with a selection of experts and practitioners. The **aim of this research was not to obtain an exhaustive or even representative list of all digital commons in Sub-Saharan African countries, but rather to measure the diversity of these commons**. Can they be found in all sectors? Do they exist on an international as well as a local scale?

In order to formulate useful working assumptions for the future operationalization of AFD's support to the digital commons, this inventory was complemented by a literature review on the subject, a series of semi-structured interviews with experts and ten case studies.

The list of identified digital commons as well as the learnings from this mapping are therefore inevitably incomplete. The aim here is to debate and complete them. All of the working documents and resources produced will be made available, to allow their reuse by other actors.

The author and the AFD teams would like to thank all the people who contributed to this work.

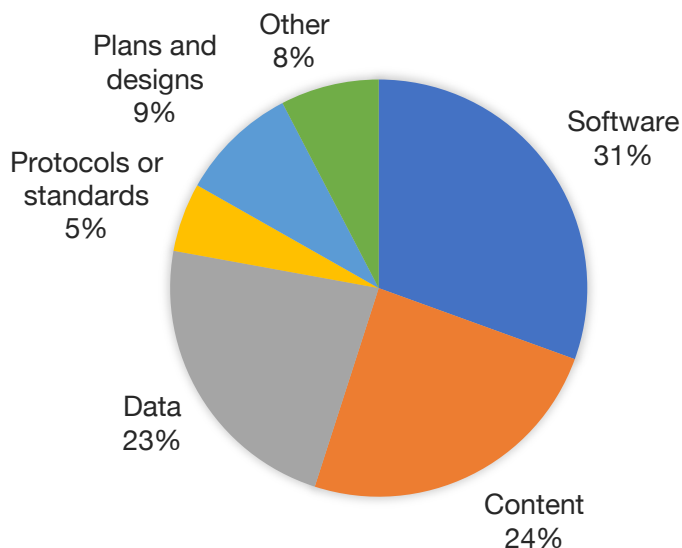
The Diversity of Digital Commons in Sub-Saharan Africa

Mapping results: a diverse catalog of resources and communities

The mapping exercise identified **89 examples of digital commons** with communities in Sub-Saharan Africa. All of the data collected can be viewed and downloaded from [Airtable](#)¹¹.

A few weeks of research by the author, combined with outside contributions, quickly identified **commons across sectors, with varying impacts, and in the form of different resources**. The identified commons also **vary in size** (depending on their number of users and contributors).

**DISTRIBUTION BY TYPE OF RESOURCES
OF THE IDENTIFIED COMMONS**

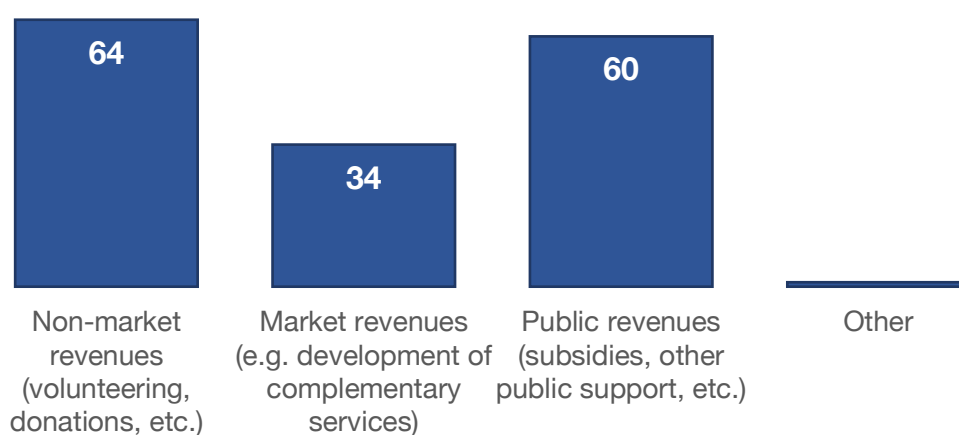


¹¹ The Airtable tool allows users to filter and browse through a collaborative catalog. Users can complete the catalog through an online form. Link to the page: <https://airtable.com/shr7Mgew9tQ99H9SU/tblI430PeFqly1Mp>

A majority of the identified commons are characterized by the **existence of a legal structure**. Informal collectives are poorly represented in the sample. The structures that support the identified commons are located approximately equally in Africa, Europe and North America.

A majority of the holders of identified commons have decided to **freeze the rules of use of the pooled resource by a free license**, sometimes with conditions of reuse under the same conditions. Finally, the identified commons use **diversified and often hybrid modes of financing**.

DISTRIBUTION OF THE FUNDING SOURCES OF THE IDENTIFIED COMMONS



The complete list of identified commons can be found in the appendix of this report.

Ten examples of emblematic digital commons identified

In order to complement the lessons learned from the mapping, AFD wanted to study ten examples of digital commons in more depth. These were chosen based on their potential impact and the African roots of their communities. They also represent a diversity of commons in terms of type of resources and sectors. The holders of these commons were interviewed in order to produce ten descriptive sheets of these commons (see below).

Name	Type of resource	Description of the common
African Storybook	Open Educational Resources	Illustrated books for children in African languages.
AfricArXiv	Content and data	Open and interoperable archives for open sharing and access to African research results.
AFRINIC	Norms and standards	Governance framework for the secure management of key Internet resources in Africa (IP addresses and autonomous system numbers).
Energypedia	Contents	Portal of knowledge and technical documentation on renewable energies.
Grassroots Economics	Digital financial assets	Community-based and inclusive complementary currency, based on open source technology that mobilizes the blockchain while working with basic cell phones.
Open MRS	Free software	Open source software for health information management. Fundamental core for the deployment of systems and specific digital medical records.
Pamoja-Net	Digital equipment	A community wifi network on Idjwi Island in the Democratic Republic of Congo.
Ushahidi	Open source software and data	An open source crowdsourcing platform for sharing real-time location information.
WaziHub	Free software, open plans and designs.	Development of open source end-to-end solutions to facilitate the development of Internet of Things (IoT) based solutions in Africa.
Wikimedia Ivory Coast	Contents	An association that represents the community of contributors of Wikimedia projects in Côte d'Ivoire.

African Storybook

Background

The African Storybook (ASb) is an initiative of the South African Institute for Distance Education (SAIDE). The initiative was born out of the growing number of studies and research showing that many African children are not attaining adequate reading literacy levels after the first three years of schooling to enable them transit to upper classes with ease. Amongst the obstacles is a severe shortage of appropriate storybooks for early reading in familiar languages. Whether children are first taught to read in a familiar or unfamiliar language, the quantity and appropriateness of reading material available to them is a significant determinant in reading success.

Impact

After piloting in Kenya, Lesotho, South Africa and Uganda between 2013 and 2017, the ASb initiative expanded to several other Sub-Saharan African countries. The ASb's alternative open license publishing model encourages use of the website for translation, adaptation and creation of picture storybooks, as well as their use in different delivery modes, formats and different audiences and contexts. The initiative's objective is to make language and content-appropriate picture storybooks more accessible to teachers and children in educational institutions such as schools and community libraries and to other literacy development organizations working with children and with under-represented language communities. The ASb initiative has over 3 000 unique storybooks, over 7 000 translations and over 200 languages of Africa represented. It also has two free apps: The Reader and Maker, which enables users to download and create their own library of storybooks on a phone/tablet to read offline, and the Maker for creating stories offline. The number of ASb users has been estimated at nearly 3 million for the year 2021.

Community

Contributions to the storybook collection come from the partnerships with other literacy development initiative, libraries and literacy Champions who are enthusiastic about children's literacy and African languages. The easy use of the Maker App has attracted and enabled children to create their own picture storybooks.

Governance

Saide is a public benefit organization registered in South Africa and governed by a Board of Directors comprised of recognized leaders in the field of education and experts in organizational development. The Board provides fiduciary, policy and strategic oversight, and Saide's Executive Director reports to the Board. ASb also has an advisory committee comprised of literacy experts from the region. The small team involved in the project is under the supervision of SAIDE's management. The decentralized system of "champions" creates direct contact with policy makers, the teaching communities in the participating countries and participates in the direction and development of the project.

Economic Model

African Storybook's development relies on a mixture of grant funding, where the team applies for support for the initiative's priorities, and commissioned project funding through the provision of an array of services ASb is able to offer, such as the facilitation of writing or translation activities in the context of targeted educational programs.

Background

AfricArXiv is an open digital archive for open access to African research outputs. The idea of creating this archive originated at the first African Open Science Materials Summit in Kumasi, Ghana, where African and international scientists met to discuss the materials and infrastructure available to them in the African context. The need for a general open repository for Africans was raised during the summit and discussed on social networks by a group of researchers who decided to launch AfricArXiv. This group decided to develop a decentralized repository, which allows the submission of publications across different existing open archives. The technical infrastructure of AfricArXiv is provided by the Center for Open Science, a non-profit organization that builds an open source infrastructure for researchers.

Impact

AfricArXiv allows African researchers to publish their research results immediately and for free. They can receive feedback on their work, improve it, and identify partners for future projects. The objectives of AfricArXiv are therefore to make African research more visible, to disseminate African knowledge, to enable the exchange of researchers on the continent and to encourage intercontinental collaboration. AfricArxiv must respond to the specific problems faced by African researchers: low international visibility, limited funding, language barriers, as well as biases and discriminations at work for integration into international publications and research networks.

Community

AfricArXiv currently has more than 350 pre-publications. The community of contributors is composed of both African researchers based on the African continent or based in a host institute outside Africa and non-African researchers who report on research conducted on African territory, or research related to African affairs.

Governance

AfricArXiv is managed by a group of volunteers. They share all the information about the coordination of their initiative through their website. The rules of submission of pre-publications are also posted online. After submission, two or more volunteer moderators participate in the verification of the reliability and relevance of the preprints.

Economic Model

AfricArXiv still relies mainly on donations and voluntary contributions. While the development of potential additional services is being explored to generate additional revenue, these have not yet been implemented. The members of the collective also want to ensure that their initiative is anchored in the African research community before seeking international support.

Background

The African Network Information Centre (AFRINIC) is the regional Internet registry that allocates IP address blocks and Autonomous System (AS) numbers for Africa. Following its establishment as a non-profit, non-governmental organization in Mauritius in October 2004, the Internet Corporation for Assigned Names and Numbers (ICANN) accredited AFRINIC as the fifth regional Internet Registry in April 2005.

Impact

AFRINIC manages a set of resources that are essential to the proper functioning of the Internet on the African continent. All service providers in Africa must apply to AFRINIC to obtain their IP numbers so that their devices can connect to the Internet. Based on international standards and norms, AFRINIC maintains the Internet routing registry and certifies legitimate resource holders (such as a block of IP addresses using the same prefix) to secure the operation of Internet routing protocols and prevent the hijacking of these routes. Hundreds of millions of IP addresses have been distributed on the continent since the creation of AFRINIC.

Community

AFRINIC's user community is the continent's Internet service providers, and indirectly, all Internet users. AFRINIC has close to 2,000 active members, mainly ISPs, governments, academic institutions and Internet users.

Governance

The policies that govern how AFRINIC manages the distribution of IP addresses and related resources are developed by the community through a working group in a transparent, open and bottom-up process. This multi-stakeholder process is open to any organization or individual who wishes to participate in defining the rules governing how Internet resources are allocated on the continent.

Economic Model

AFRINIC is funded primarily through membership fees. AFRINIC also earns revenue from fees associated with its resource allocation and disposition services, as well as from support and capacity building activities for research institutions or critical infrastructure (such as IXPs) on the continent. AFRINIC may also receive donations or grants, including for the organization of international events and meetings.

Background

Energypedia was initially created as an internal tool for knowledge management of energy-related projects within the Gesellschaft für Internationale Zusammenarbeit (GIZ), the German development agency. Gradually, the interest of external partners increased for this resource, which led GIZ to make this wiki public and freely accessible to all in 2011. In 2012, the energypedia project was outsourced to become an independent NGO.

Impact

Energypedia is a wiki platform for collaborative knowledge exchange on renewable energy, energy access and energy efficiency in developing countries. The goal of energypedia is to break down knowledge barriers and expand the dissemination of information on these topics. In 2021, energypedia had more than 5,000 articles viewed nearly 2 million times during the year.

Community

Energypedia currently receives nearly 90,000 monthly visits from 212 different countries. By 2021, there were nearly 12,000 registered users on energypedia. According to surveys conducted by its teams, the majority of users are from the global South. A significant number of contributors work for NGOs, others for the public and private sector. Some contributions are therefore made in the context of activities remunerated by employers wish to participate in the development of this resource to document their work. While energypedia actively seeks to develop contributions from experts in sub-Saharan Africa through partnerships, it never pays its contributors directly.

Governance

Energypedia is an NGO based in Germany, working with a small team of mostly part-time staff. This team of employees has developed rules of conduct for contributors, such as prohibiting the promotion of fossil or nuclear energy, or advertising content to promote specific business solutions. This team also maintains the standards of writing and organization of the articles, without checking the quality of the content in detail. Contributors can therefore freely contribute to the wiki and submit ideas for strategic actions but do not directly participate in defining the NGO's orientations.

Economic Model

Energypedia relies mostly on public funds, as well as on donations from individuals. Public funds are usually provided through grants from development agencies. While energypedia still works with GIZ, it has diversified its portfolio of partners. A private company, energypedia consult GmbH, was developed in 2012, with the aim of developing monitoring and knowledge management consulting and energy program evaluation services and returning its profits to the NGO. While these funds cover some recurring costs such as wiki maintenance, they are not sufficient to fund all of the platform's activities.

Grassroots Economics

Background

Grassroots Economics is a non-profit foundation that aims to foster economic development through the introduction of local and inclusive complementary currencies. Grassroots Economics was born in marginalized communities in Kenya. Its first Bangla-Pesa complementary currency project was implemented in 2013 in the Bangladesh slum near Mombasa. The foundation is now developing complementary currency projects in 45 localities in Kenya and wishes to support their deployment throughout the world. The Sarafu network, developed as an open source project by the foundation, is a decentralized technology that provides the protocols for securing the accounts of users of the digital currency designed by the foundation. It uses USSD technology which allows any cell phone to use this currency (even without an Internet connection).

Impact

The complementary currencies developed by the Grassroots Economics Foundation work like interest-free vouchers or credit bonds. The value of these vouchers is based on the community of small businesses and local consumers recognizing the currency created. The community can set its own rules for issuing and distributing the currency. According to evaluations of programs conducted by the foundation, the introduction of these currencies, as a complement to national currencies, has created a stable medium of exchange for local development, reducing dependence on external liquidity and markets. As a result of the development of this new local financial service, the communities that have participated in these programs have experienced an increase in trade, investment and job creation.

Community

The foundation's programs have been implemented in 45 locations in Kenya and 2 locations in South Africa. They have reached over 60,000 organizations and individuals. The foundation describes the arrangements between members of these communities as "economic commons," open associations of people and organizations with the goal of creating an inclusive community and purchasing power.

Governance

The Foundation has created the Grassroots Economic Commons License (GECL), an open license that defines the rights and duties of the economic commons community. The foundation supports communities in using this license and adapting resources and tools to community needs.

Economic Model

The foundation's activities are financed through grants and donations, mainly from donors or non-governmental organizations in the framework of development programs that use the approach and services deployed by the foundation.

Background

OpenMRS was originally conceived in 2004 by several organizations working to improve care for HIV patients in Kenya and Rwanda. However, OpenMRS was quickly developed as a generic medical record system capable of handling the full range of patient health information, and rendering it in summaries, reports, and data views that could improve the efficiency of those using the system. Deployments of Open MRS in a variety of contexts quickly multiplied: by 2010, OpenMRS was deployed in 23 developing countries, primarily in Africa, reaching nearly one million patients.

Impact

From a handful of founding organizations, OpenMRS has evolved into a global community based on the principles of openness and sharing. OpenMRS is software built to support modules, which allow the solution to be adapted to local needs. Open MRS is now present in more than 40 countries and over 6,000 sites. Open MRS manages the medical records of nearly 16 million patients.

Community

The Open MRS contributor community includes small service companies that deploy the software locally, international healthcare organizations, and research institutions. Over the past 15 years, the number of contributors from the global South, particularly sub-Saharan Africa, has grown significantly. More and more companies that provide services around customization and deployment of Open MRS are participating in updating the core software or sharing new features with the rest of the community.

Governance

Open MRS is an NGO registered in the United States. It supports community-driven software development through distributed governance that involves stakeholders in maintaining and deploying Open MRS. The NGO's teams are dedicated to tasks that are essential to the community. Software development is carried out by squads of volunteer contributors. Committees allow community members to monitor important technical and strategic decisions of the NGO.

Economic Model

The creation of a legal entity, in the form of an NGO, has allowed Open MRS to receive public funding. The latter represents the bulk of the NGO's revenue, as it does not wish to develop services that could compete directly with the organizations that deploy and contribute to the development of its software.

Genesis

Pamoja-Net is a community wifi network set up from 2016 by the NGO La Différence on Idjwi Island, an island in Lake Kivu which is located in the Democratic Republic of Congo (DRC), between Goma and Bukavu. La Différence is an NGO that promotes social entrepreneurship, particularly among younger populations. It is based in the DRC and the United Kingdom. Following an invitation by the "Mwami" (or king) of the island, the NGO decided to invest in the establishment of a community network to open up the island, which had remained disconnected from telecommunications networks.

Impact

A majority of the 300,000 inhabitants of Idjwi Island live well below the poverty line. Indeed, the island has no infrastructure or industry, and its economy remains poorly developed, despite the cultivation of a high quality coffee. Internet access has connected several businesses and cooperatives and over 6,000 individuals. According to an evaluation conducted by the NGO, 98% of the new users of the network feel that the project has contributed to a positive change in their lives, through "new abilities to connect with family and friends, conduct educational research, apply for a job, check weather reports before fishing on Lake Kivu or save money. The main coffee growers' cooperative has been able to expand its operations and find new international clients.

Community

The first users and contributors to the network are local businesses, who have agreed to fund the monthly connection cost of approximately \$800. The cost-sharing offered by the use of a community wifi has reduced the costs for these businesses, compared to the costs of installation and individual subscriptions with a conventional Internet service provider. These companies contribute to pay for the maintenance of the network but also for a small kiosk, which allows all the inhabitants of the island to benefit from the bandwidth outside working hours. The kiosk is located in the middle of the main market of the island and must participate in the support of the inhabitants in the uses of the network.

Governance

The governance of the network is closely linked to the island's chieftaincy, headed by the king. The king has set up various commissions to discuss public issues, including a commission that deals with communication and issues related to the network. La Différence's teams meet with this commission once a week to evaluate the evolution of the network and to discuss possible disfunctions. The network's management rules were thus discussed in advance with all the stakeholders. Belonging to the existing chieftaincy system was seen by the inhabitants as a way to ensure that the project belongs to the community and remains autonomous.

Business model

While the network still relies on grants and donations, 60% of the operating costs are funded by local businesses. The initial investments needed to set up the network were raised by the NGO from donors and philanthropists.

Background

In 2007, post-election violence broke out in Kenya. A widespread media blackout prevented millions of Kenyans from accessing information about the situation in the country and from getting to safety. In a few days, bloggers and personalities of the digital ecosystem decided to build together a platform to collect testimonies from citizens by SMS and on the web. More than 40,000 testimonies, geolocated and time-stamped, were shared during these events. These testimonies allowed the development of an alert system for people in the vicinity of the violence and, more broadly, to inform the whole world about the evolution of the situation.

Impact

Ushahidi means witness in Swahili. Ushahidi's goal today is to help marginalized communities around the world to raise their voices. The platform developed by Ushahidi, freely reusable and modifiable, has been used more than 200,000 times in over 160 countries. It has collected more than 50 million testimonies from citizens around the world, threatened by natural disasters, human rights violations, corruption or harassment. These testimonies help to improve access to information, increase government transparency and better respond to crisis situations.

Community

Ushahidi's user community has progressively expanded to the whole world. Among the most active communities are contributors to the Syriatracker, Harassmap, iWitness, Abaaraha or Mapping Media Freedom projects. While Ushahidi has an international team of 15 experts from 7 different countries, it has adopted an open strategy to allow these communities to participate not only in the updating of its platform, but also in its design and in the writing of user manuals.

Governance

The maintenance of the Ushahidi Platform is managed by a non-profit organization by the same name based in Kenya. The rules for the management and use of this platform, and in particular the data collected, are defined by the communities using the platform themselves. Ushahidi only requires these communities to respect the rules relating to the protection of personal data and privacy.

Economic Model

With the high visibility that the platform gained following the violence in Kenya, Ushahidi has been able to benefit from a significant amount of financial support, both from international public organizations, foundations, and private companies, in the form of donations and grants. While the organization still relies mostly on these financial supports, it has developed new sources of revenue by offering advisory and support services for the deployment of its tool to certain communities.

Background

WAZIHUB (Open Hub in Swahili) is a project to stimulate innovations in the Internet of Things (IoT) and Big Data in Africa. It was launched in 2015 following an application to a call for projects from the European funding program Horizon2020 to support the development of open technologies for the African continent.

Impact

The goal of the WaziHub project is to develop open software and hardware to enable African entrepreneurs to easily create solutions based on these technologies. These open resources are intended to remove the barriers that prevent African innovators from entering the IoT field. The project offers end-to-end resources and support: it provides a free development kit for rapid prototyping of solutions, based on open source software and hardware, but also offers completely free access to a cloud computing platform to develop custom applications, via an open API to connect to it. The project then provides access to capacity building trainings for entrepreneurs and connects them with experts and researchers in the IoT field.

Community

About 48 startups have used WaziHub's technology to develop solutions. More than 2,000 people have used the project's resources and taken training. WaziHub works closely with innovation centers in several countries across the continent. The technology offered by the project is fully open source and developed on GitHub with a small community of developers. The code developed has already been cloned several times by other communities.

Governance

The consortium behind the WaziHub project is coordinated by the Bruno Kessler Foundation, based in Italy. The consortium includes 7 partners from 4 African countries (Burkina Faso, Ghana, Senegal and Togo) and 5 partners from 4 European countries (France, Germany, Italy and Portugal), and brings together developers, technology experts and African companies.

Economic Model

The project is mainly funded by public grants. It has been developed with European stakeholders in order to facilitate access to funds from the European Union and its member countries.

Wikimedia Ivory Coast

Genesis

The first traces of Côte d'Ivoire's contribution to the Wikipedia project date back to 2005. Since then, various informal groups have been formed, notably under the impetus of civil servants who decide to document the newly created Ivorian communes in the late 2000s. The Wikimedia Community User Group of Côte d'Ivoire was officially created in 2014, the year an association was established in Côte d'Ivoire and affiliated with the Wikimedia Foundation. The goal of the association is to organize public awareness activities at the national level, to federate and represent Ivorian Wikimedians, and finally to collaborate with the international Wikimedia community.

Impact

The members of the Wikimedia community of Côte d'Ivoire adhere to the objectives of the Wikimedia Foundation, i.e. the development of educational content under free licenses or in the public domain, in order to allow their effective dissemination worldwide. They also wish to contribute to take a more important place in the debate and representations that concern their country. Finally, some of the group's projects should also help defend linguistic diversity. The association trains about 100 people per year to use and contribute to Wikimedia projects.

Community

The Wikimedia Côte d'Ivoire community is open to all contributors to Wikimedia Côte d'Ivoire. Since the creation of the association, more than 200 people have created an account to contribute to Wikimedia projects from Ivory Coast. About 20 contributors are regular contributors (who contribute at least 5 times a month). More than 5 million pages of the Wikimedia Foundation's projects are consulted per month in the Ivory Coast, according to the foundation's statistics.

Governance

The association is governed by its general assembly. It is the executive committee of the association, elected by the general assembly, which acts on a daily basis for and on behalf of the association. If the association has been able to recruit a small permanent team to support its activities, the projects carried out are generally carried out by volunteers and organized in a decentralized way within teams of volunteers.

Business model

The majority of the association's funding comes from its partners for the realization of projects or campaigns. A small part of the funding also comes from one-off donations and annual membership fees.

Five Assumptions on Digital Commons in Sub-Saharan Africa

ASSUMPTION #1

Only a few of the diverse African initiatives studied self-identify as commons

Among the initiatives identified in the mapping exercise, there is almost no example of an initiative that presents itself as a commons. Only two initiatives clearly display this concept in their description: AfricArXiv and Laws.Africa.

Some of the initiatives studied were in fact initially formed around a specific response to a specific problem. The values of openness, shared governance or simply collaboration are elements that are gradually grafted onto the project, often out of necessity, when the solution requires the mobilization of a community, for example. This is the case of the Ushahidi platform, which chose to open up its collaborative mapping tool after its launch during the political violence in Kenya in 2008. The objective of this opening is to increase the accessibility of its tool to other communities before being an end in itself.



The concept of the commons is a bit abstract, it's not a familiar term at all, even for a Wikipedian who might be aware of it. There are many initiatives that flirt with the concept without naming it. Users and contributors don't care about these theoretical implications.



**Donatien Kangah,
Wikimedia Community User Group Côte d'Ivoire**

Nevertheless, many initiatives carry political values. Most of them share a commitment to the free flow of information and knowledge, to transparency and to technological and social innovation. Some initiatives base their action in decolonial struggles and affirm the need to develop infrastructures, tools and contents that highlight the languages and cultures of African countries. This is the case, for example, of many "Wiki User Groups".

The digital commons in Sub-Saharan Africa do not therefore appear to be a uniform and structured movement. The digital commons identified are generally structured by type of resource, particularly at the pan-African and international levels. In particular, we observe networks or communities of exchange constituted around the typology below. For more details, a mapping of key actors is attached to the results of this study.

Movements	Examples of networks or communities of exchange in Sub-Saharan Africa
Free and open-source software	Free Open-Source Foundation Africa (FOSFA) Open-Source Community Africa (OSCA)
Open Science	Afric'ArXiv Association for the Promotion of Open Science in Haiti and Francophone Africa
Fablabs and maker movements	Africa Open Science and Hardware (Africa OSH) Francophone Network of West African Fablab (ReFFAO) African Maker Magazine
Open government (open data and civic tech)	Africa Open Data Open Government Partnership African Union Civic Tech Fund
Open Educational Resources	Open Education Global OER Africa
Community networks and wifis	Internet Society (ISOC) Association for Progressive Communication (APC)
Open access to knowledge	Wikimedia User Groups Creative Commons



At AfricArXiv, we contribute indirectly to the discourse on the knowledge commons. Within academia, there are research-specific conversations around Open Science, Open Access, Open Source and related topics all of which are connected to the research workflow from project idea to publishing. The term ‘commons’ is hardly ever mentioned, even if the same intention is underlying. There are certainly many parallels and overlaps with other commons-oriented communities and stakeholder groups, especially with regards to open licensing options, all of which are contributing to the global knowledge commons.

Jo Havemann, Co-founder Afric'ArXiv, Germany/Kenya



Nevertheless, we can note a more frequent use of the notion of the commons within fablabs and third places, which notably allow different actors of the above communities to converge and meet physically. One example is Kër Thiossane in Senegal, a space that has developed the "School of Commons, a societal laboratory based on artistic experimentation, free culture and shared knowledge".¹²

¹² https://www.ker-thiossane.org/pn/l_Ecole_des_Communs

ASSUMPTION #2

Sub-Saharan African communities that participate in the development of commons rely primarily on a few highly committed citizens

The digital commons are regularly found in spaces left empty by the private and public sectors. They are nonetheless dependent on the public and private spheres. The fragility of states, the weakness of private investment, and in the particular case of the digital commons, the limits of access to the Internet and to equipment, also weaken the capacities of communities to manage, maintain or develop shared digital resources. Thus, it is not surprising to observe a correlation between the number of active contributors on Github (a platform that hosts and manages versions of collaboratively developed open source software) and the number of digital sector companies in a country, and thus the level of economic development of a country¹³. Similarly, the number of active contributors on Wikipedia per country is correlated with human development indices.

A 2017 Internet Society report on community wifi networks¹⁴ is thus surprised by the relatively small number of community wifi networks given the size of the population of the African continent. Among the barriers to the development of these communities are mentioned:

- Low awareness of the potential benefits of better access to information and the possibility of creating one's own infrastructure autonomously;
- Low income compared to the high cost of Internet access and equipment, and even access to electricity;
- Limited development of certain technical skills;
- The lack of a regulatory framework that is conducive to community-based initiatives.

The "digital divide" would therefore also translate into a weaker capacity to organize at the community level to develop and manage digital resources autonomously. This hypothesis would explain the relatively small number of digital commons identified in the agricultural sector, or digital commons developed directly for farmers in Sub-Saharan Africa, given the importance of this sector on the continent.

The fragile development of the commons in Sub-Saharan Africa is also explained by the lack of institutional support, i.e., limited awareness of the potential of the digital commons within states, public agencies, and large and medium-sized enterprises.

¹³ Johannes Wachs, Mariusz Nitecki, William Schueller, Axel Polleres, The Geography of Open Source Software: Evidence from GitHub, Technological Forecasting and Social Change, Volume 176, 2022, 121478, ISSN 0040-1625, <https://doi.org/10.1016/j.techfore.2022.121478>.

¹⁴ https://www.internetsociety.org/wp-content/uploads/2017/08/CommunityNetworkingAfrica_report_May2017_1.pdf



Our institutions have never given free software the place it deserves in terms of promotion and support. I am frustrated by this experience: the leaders have not understood that they have a treasure in their hands that they do not use. The initiatives are essentially developed from below by civil society, and often carried by one or two strong personalities.



Florent Youzan, free software advocate, Ivory Coast

In particular, the interviewees explain that, apart from fablabs, most digital innovation spaces do not put forward models that deviate from traditional intellectual property schemes. Indeed, while the potential of open models has been identified to promote the pooling of efforts and the scaling up of certain innovations at the continental level¹⁵, the people interviewed note the predominant interest of young entrepreneurs and startups for proprietary systems that should quickly allow them to monetize their investments. Indeed, it seems that for a large part of the population, it remains difficult to afford to participate in activities that do not generate immediate income.

Nevertheless, we note that some software development companies contribute to open source projects, such as Andela¹⁶ and that in several countries such as South Africa, Nigeria, Kenya but also the Democratic Republic of Congo we find more than 100 000 active users on Github in 2021¹⁷.



There are many organizations, many initiatives. But very few work in an open way, even though their approach is beneficial. We really need to change this approach to pool more efforts and share results, especially data. We have this reflex of duplication, especially in tech. Younger people naturally want to innovate and develop new projects, but we lose a lot of energy that way. Creating digital commons is about true innovation, doing something new based on what already exists, rather than reinventing the wheel.



Mamadou Diagne, Open Knowledge Senegal Ambassador

Nevertheless, the development and management of the digital commons remains fragile and relies largely on the efforts of civil society or the education and research sector. There are a number of communities led by a few activists in the field of civic solutions to strengthen government transparency (civic tech)¹⁸ and in the field of open science. One can find contributors with fixed incomes, who engage in collaborative projects out of passion and often in their spare time.

¹⁵ <https://openair.africa/scaling-innovation-how-open-collaborative-models-help-scale-africas-knowledge-based-enterprises/>

¹⁶ <https://andela.com/insights/open-source-projects-built-andelans/>

¹⁷ <https://octoverse.github.com/#future>

¹⁸ <https://civictech.africa/database-list-of-initiatives/>

According to the people interviewed who participate in the animation of local Wikimedia or Open Street Map communities, the vast majority of contributors are young people with degrees, or in the process of obtaining one, who participate as individuals, often as part of a civic commitment and sometimes to develop skills and increase their employability. This typology of contributors sometimes contributes to the fragility of communities over the long term, due to high turnover. For the most active members of these communities, participation in the commons can also be a springboard to join the private sector or international organizations.

ASSUMPTION #3

The sustainability of the identified commons depends heavily on their ability to mobilize international support

The transition from a one-time collective collaborating on a specific project to the management of a perennial resource, with a community that remains active, is a difficult path for many emerging civil society initiatives. Maintaining a social dynamic around the development or maintenance of a resource requires ensuring the continued interest of a group of users and contributors, which in the context of the digital commons, are often distinct groups.

The mapping revealed that to ensure their sustainability, digital commons in Sub-Saharan Africa, given the fragility of institutional support in their countries, must generally try to nurture a third community: a community of international donors or funders, in order to capture grants or develop regular programs that can be funded.



The environment in which we work is a particularly poor one. Many people earn less than a dollar a day. We knew that it would take many years before we could raise the money to operate solely on the basis of these people's incomes, especially to launch other initiatives. So we need donations and grants to start our projects. Currently our community network is 60% self-supporting. The remaining 40% is based on external financial support.

**Patrick Byamungu, Pamoja-Net,
Democratic Republic of Congo**



Maintaining this community of supporters also requires professionalization in the management of the commons, creating a legal entity, drafting statutes, opening a bank account, but above all recruiting staff capable of responding to calls for tender or writing grant applications. These teams quickly take on a decisive role in the management of the resource

and must have skills in project management and evaluation in order to meet the criteria defined by the various donors.

Thus, digital commons that become institutionalized typically establish a specialization of roles among the groups involved in their management. This observation comes from the open source communities, which have progressively identified the following four groups as key to the success of open software¹⁹ :

- Users, who derive value from the common ;
- Contributors, who contribute to the maintenance or development of the common ;
- Maintainers" (or administrators), who are responsible for the permanent organization of the commons and have the rights of management, exclusion and alienation;
- The "sustainers" (or backers), who participate in the financing of the common.

It is important to note, however, that a significant number of the digital commons identified have hybrid funding models, combining donations, public subsidies, and market revenues, for example via an offering of commons-related services. This is the case for many software products. There are both companies that maintain the software with a community while offering services and organizations that essentially organize collaboration around a software core by different companies that offer consulting or software specialization services to customers.

However, the open source software identified is also experiencing difficulties in maintaining itself in the long term or in scaling up without recourse to public subsidies. The same questions about the sustainability of open educational resources can be found within the dynamic coalition of UNESCO on this subject²⁰ . The development of a digital commons remains associated with a certain amount of risk, given the uncertainty surrounding its use and the possibilities of monetizing services. Nor does it allow for guarantees via material incorporations. Financing through fundraising or bank loans is therefore extremely rare.

ASSUMPTION #4

The positive impact of access to the global digital commons in sub-Saharan Africa is increasingly recognized

While the use of the commons concept remains limited, many global digital commons are now part of the digital daily lives of thousands of Africans. These include Wikimedia and OpenStreetMaps, which have large national communities on the continent, especially among

¹⁹ Open Source Summit, 2017

²⁰ <https://fr.unesco.org/themes/building-knowledge-societies/oer/dynamic-coalition>

students²¹. Africa's Internet infrastructure as well as network and server management tools also rely heavily on digital commons, such as Apache. Interviews revealed a particularly high use of OSS among small businesses in the service sector as well as among individuals. From operating systems to office suites (LibreOffice), text editing (Scribus, FontForge), audio and video editing and 3D creation (Blender), or website creation (Drupal, Wordpress), there are many open source resources that provide easy access to key services at lower cost. We can also note the use of free hardware in FabLabs, such as free motherboards like Arduino, or the open plans of Jerry's, which allow to build a personal computer inside reused cans, and the free operating system Emmabuntus.

There is also a growing interest in open source software in the public sector, where the possibilities of pooling and reducing costs are recognized. In particular, we observe a very wide use of open source software in the health sector, for example for patient information management systems. Several solutions were originally developed to meet the needs of sub-Saharan African countries, before being deployed worldwide. For example, the list of the top 10 countries where Open MRS has been downloaded from the SourceForge platform includes countries in Southeast Asia and Sub-Saharan Africa (Kenya, Nigeria and Uganda).

Based on this observation, new initiatives for international collaboration in the development and maintenance of shared digital infrastructures are emerging. One example is GovStack, which plans to co-develop key components for core digital services for governments²².

These initiatives face two major difficulties, however: the ability to estimate or measure the value of a non-marketable intangible resource and the uncertainties about the real need and future reuse of the software developed. Indeed, some respondents mention the natural tendency of volunteer contributors to do what they want to develop rather than to respond to a user need.



A methodology is needed to look for spaces that states and markets cannot really fill, but where there is an identifiable collective value and therefore a potential demand. The question of defining the resources to be developed is very difficult: there is a significant amount of risk and uncertainty, which compromises public funding. Measuring impact is also complex: it is not always clear who will benefit from a resource and benefits are often indirect, as opposed to material resources. It is important to realize that when a resource does not yet exist, one can only make assumptions about the possible uses and objectives of the actors. This is necessarily risky and experimental. We must therefore be careful not to create expectations that are too high.

**Lea Gimpel, Program Co-Leader
FAIR FORWARD, GIZ, Germany**



²¹ <https://wikimediafoundation.org/de/news/2017/09/21/nigeria-wikipedia-awareness/>

²² <https://www.govstack.global/>

ASSUMPTION #5

Digital commons in Sub-Saharan Africa participate in citizen struggles to decolonize knowledge and culture and support local value creation

Among the communities studied, it can be observed that projects with a strong local anchorage are often based on a desire to decolonize knowledge and culture and to participate in local development. Thus, we find many projects that wish to valorize the languages and cultures of African countries, through the creation of content for example. Similar ambitions can be observed in projects that aim to produce true national intangible infrastructures, such as mapping projects, to accompany economic transformation. This is the objective of Digital Umuganda in Rwanda, a startup that relies on the ancestral concept of Umuganda, according to which everyone participates once a month in work of collective interest, to have a young population contribute to the development of databases that allow the development of artificial intelligence applications, notably for voice recognition in Kinyarwanda (Common Voice Kinyarwanda).



The commons contribute to the development of the country, through the sharing of knowledge, but also to the valorization of our culture, our language. Behind the commons there is a civic commitment, a desire to carry the way of Africa. We do not want to let others carry our history. Wikipedia gives us the opportunity to speak and make ourselves known.

**Donatien Kangah,
Wikimedia Community User Group
Ivory Coast**



In contrast to these initiatives embodied by African project leaders, some respondents point to the persistent problem of the lack of an integrated approach to programs supporting shared digital resources, which still does not sufficiently combine support for the development of a global resource with capacity building on a local scale. We should therefore think about the entire "life cycle", the value chain around the commons. For example, if we want to create local value, we must also think about communication and dissemination strategies for the resource, and even training for potential users. This approach requires taking into account all the social structures at work in the production and reception of a resource, much more than the nature of the resource itself. Knowledge, for example, is much more the result of a learning process, and therefore of a social process, than the simple digital

formalization of a set of information. This is the interest that "communities of practice" bring, these horizontal communities that can, in the context of the digital commons, form around a resource and thus participate in the reinforcement of the capacities of its members through collaboration and sharing.



We learned a lot in the first ten years. In 2019, we had to change much of our strategy as our community grew and it became increasingly difficult to make decisions. We created a new distributed governance structure with teams called squads. They are composed of people who want to work on a specific problem. This is how projects are launched. They decide when and how they will meet. They decide on their objectives and timetable. They don't need to ask anyone's permission to start the project. We support them and ask only that they continue to use our shared resources to document their work.

**Jennifer Antilla, Community Manager
OpenMRS, USA**



These modes of collaboration therefore require a decentralization of community governance, but also a true appropriation of the resource by the communities. Indeed, several interviewees point to the importance of governance centered on the needs of Sub-Saharan African countries, in order to avoid the risks of new dependencies. In a joint report on the digital economy by the Digital Impact Alliance and the Smart Africa Alliance in 2021, we observe, for example, the reluctance of African public purchasers to favor open source solutions developed mainly in the global North when they are in competition with local digital actors²³.

This fear refers to a second essential aspect of the question of governance of the digital commons - that of defining rules of use, and potentially rules of use that allow for the creation of value on a local scale. While some respondents mention the use of copyleft licenses, which more strictly regulate the uses of a resource in order to avoid the capture of value by a few actors for their own profit, others praise the benefits of cooperative models to ensure the maintenance of common resources according to democratic decision-making methods. This is the objective of a partnership between the Fabrique des Mobilités and the Tanzania Open Innovation Organization, who wish to develop a booking platform for motorcycle cab drivers, while accompanying these drivers in the creation of a cooperative in charge of managing this platform.

Finally, there are also several examples where governance is based on older, pre-colonial social structures. Pamoja NET relied on the traditional chieftaincy system on Idjwi Island to consult with all of the island's stakeholders before and during the deployment of its community network.

²³ https://smartafrica.org/wp-content/uploads/2020/12/SmartAfrica-DIAL_ExecutiveSummary_Call-To-Action_ENG-v5.pdf

Conclusion and courses of action for AFD

Participate in the creation of an enabling framework for the growth of the commons

International organizations and states must participate in the creation of a framework favorable to the development of the digital commons. To this end, an international dialogue must be launched on the preservation and protection of the public domain of information, the promotion of the use of free licenses, particularly in the context of public funding, and the modes of support for the digital commons. The Digital Public Goods Alliance offers a first discussion space to exchange best practices in supporting the digital commons and to improve the understanding of models for valuing and financing these resources.

A targeted reflection could be organized specifically on the potential of the digital commons for education and innovation. This reflection should lead to concrete modalities to fully exploit the potential of the digital commons for pooling scarce resources available to low-income countries to develop and use key technologies. It should also identify ways to promote the commons as a method of learning through contribution and integration into communities of practice, particularly in higher education. The digital commons offer the possibility to develop skills and knowledge that are complementary to traditional training (communication skills, organization, teamwork, etc.). In this context, greater visibility and financial resources must be given to fablabs, which participate in both education and digital innovation.

Finally, the opportunity to finance digital commons should be studied by default for each support program developed by international donors, in order to increase the coordination and efficiency of their actions. The combination of traditional technical and financial support with digital commons could also be considered, in order to leverage the impact of these programs. This is the case of the "2050" sustainable investment fund, which reserves a portion of its financing for open and strategic resources that participate in accelerating the transformations required to meet humanity's most urgent challenges.

Financing digital commons through the creation of dedicated and specialized funds

Most governments have limited experience in collaborating with and supporting communities that may not be very institutionalized. These communities generally wish to remain autonomous and avoid any risk of political control.

In order to meet this demand, but also to optimize the coordination of support measures among donors, the creation of specialized funds or intermediary structures with the mission of supporting these communities appears to be an appropriate solution. The funds could follow thematic principles and orientations and their governance could be shared, notably with actors from the commons ecosystem in Sub-Saharan Africa.

Rather than a global program to support the commons, a targeted action by typology that relies on intermediate African structures, which represent a set of communities that have developed knowledge, resources, and networks, seems the most relevant. This approach should make it possible to take into account the specificities and contexts of each type of resource, particularly in terms of financing needs. The feeding of a content platform, for example, requires recurrent and sustainable funding, whereas the operating and maintenance costs for digital equipment may be limited compared to the initial installation costs.

To reach communities in Sub-Saharan Africa that are often organized from the bottom up, it is necessary to adapt funding tools to meet their needs and their capacity to manage funds over the long term. Support through funds or intermediary structures, which could distribute grants on the basis of relatively small volumes, could be considered. This financing could be inspired by the Call for Proposals in France or by the Lacuna Fund's calls for thematic projects.

Develop technical support services to incubate digital commons

The holders of the commons could be supported by a transversal offer of expertise on economic models and open modes of governance, in order to help them define a strategy to ensure their long-term sustainability. This offer of technical expertise could essentially be developed through exchanges between common carriers. The interviews conducted as part of this study have indeed shown that the commons are more structured according to their sectors of activity or the types of resources they govern. A transversal exchange on the modes of governance and sustainable management of digital commons could thus benefit commons holders.

International organizations supporting sustainable development could be inspired by initiatives such as WazyHub to define a methodology for supporting the commons that allows for an approach that integrates all the factors involved in the success of a commons, from its production to its use, and that allows for scalable support to adapt this support to the needs of communities.

In this way, some common carriers could be supported in the development of their modes of governance or financing. This is the purpose of the collaboration between ADEME and the Tanzania Open Innovation Organization, which is supporting motorcycle cab drivers in the creation of a cooperative, supported in the form of a loan, to develop and maintain an online platform for booking motorcycle rides.

Encourage states to collectively commit to the funding of jointly managed critical digital infrastructure

Political awareness of the benefits of some globally shared digital commons is growing, as we noted in our first section. This is particularly true for commons related to digital identity, cybersecurity, or network management. This awareness must be accompanied by a shared responsibility to preserve these commons - or to participate in the emergence of new collective infrastructures managed in common.

This responsibility could be supported by international donors, in order to guarantee investments by low-income states in digital infrastructures that meet their specific needs, while ensuring that these do not benefit a handful of economic actors, i.e. by promoting interoperability to prevent "lock-in" by digital solution providers. This method could be particularly interesting to ensure the sustainability of the solutions developed, especially if international communities of developers are involved on the one hand, and local IT service companies, which deploy and adapt these solutions, are involved in the governance of these commons on the other.

Based on specific interest and commitment from multiple states, which begins with in-depth studies of shared needs among a group of jurisdictions, these projects could be funded through grants or soft loans. This is the approach being tested in the GovStack initiative.

Govstack plans to finance the development of "building blocks" of software solutions for the digital transformation of administrations, ensuring their openness and interoperability.

Appendix 1 - List of Common Areas Identified

Africa GeoPortal	The Africa GeoPortal houses hundreds of ready-to-use datasets. Some are provided by Esri, others by users and organizations specializing in Africa.
Africa Open DEAL	The Open D.E.A.L (Data for Environment, Agriculture and Land) initiative has made Africa the first continent to complete the collection of accurate, comprehensive and harmonized digital land use and land use change data. It provides a detailed snapshot of the continent, captured through more than 300,000 sample points collected by 350 operators over two years.
African Bird Atlas Project	Focusing on birds, which are excellent indicators of overall environmental health, the African Bird Atlas project-a well-established citizen science project-is designed to collect data on bird distribution over large spatial scales. It is unique in its ability to report on changes in biodiversity in real time and thus provide researchers and policy makers with up-to-date information.
African Storybook	Free access to illustrated storybooks in African languages. For the literacy, pleasure and imagination of children.
AfricArXiv	AfricArXiv is a community-based digital archive for African research, whose goal is to create an African-owned open scholarly repository, a knowledge commons around African scholarly work, to catalyze the African Renaissance. AfricArXiv partners with established scholarly archiving services to provide a platform for African scientists of all disciplines to present their research findings and connect with other African researchers.

AFRINIC's Resource Certification Program (RPKI)	Resource certification is a security framework for verifying the association between digital Internet resources (IP addresses and autonomous system numbers) and their rightful owners. It aims to add a verifiable form of an owner's current right to use these resources on the Internet. An important element of the resource certification framework is the Resource Public Key Infrastructure (RPKI).
AfTerFibre	AfTerFibre or African Terrestrial Fibre is a map of African terrestrial (and now submarine) fibre infrastructure initiatives. It was developed with initial support from Google and is now hosted and supported by the Network Startup Resource Center.
AgShare Planning and Pilot Project	The goal of the AgShare planning and pilot project was to create a scalable and sustainable collaboration among existing African organizations to publish, locate, and share teaching and learning materials that would fill critical resource gaps in African agricultural curricula.
AirGeo	AirGeo: air, earth and bark" is an interscience, international, and participative investigation booklet that aims to show the march of a citizen science in action, mediated by design, drawing, theater, radio, and literature for a citizen participation.
Akoma Ntoso	Akoma Ntoso (Architecture for Knowledge-Oriented Management of African Normative Texts using Open Standards and Ontologies) is an international technical standard for representing executive, legislative, and judicial documents in a structured manner using a domain-specific legal XML vocabulary.

Apache Fineract	Apache Fineract is open source software for financial services. Fineract provides a reliable, robust and affordable solution for entrepreneurs, financial institutions and service providers to deliver financial services to the world's 2 billion underbanked and unbanked people. Fineract targets innovative mobile and cloud-based solutions.
Appropedia	Appropedia is the site for developing and sharing collaborative solutions to sustainability, poverty reduction and international development through the use of sound principles and appropriate technologies, original research and project information. We are a wiki, a type of website that allows anyone to add and edit content. To contribute, we simply ask you to create an account.
Arduino	Arduino designs, builds and supports electronic devices and software, giving people around the world easy access to advanced technologies that interact with the physical world. Arduino's products are simple, straightforward and powerful, ready to meet the needs of users, whether they are students, makers or professional developers.
Audiopedia	Equitable access to life-saving knowledge for all
Beautiful Trouble	Beautiful Trouble is a book, a deck of cards, a web toolkit, a creative campaign incubator and an international network of artist-activists-trainers who help grassroots movements be more creative, effective and compelling.
Bisa Health Application	Bisa Health Application aims to pioneer telemedicine in Africa on two main fronts: first, the dissemination of information on disease prevention and control and, second, the linking of patients and doctors through technology.

BOSCO Uganda	Battery Operated System for Community Outreach (BOSCO) Uganda is a non-profit organization under the Catholic Archdiocese of Gulu, founded in 2007. Its mission is to provide innovative information and communication technology (ICT) solutions using a collaborative, web-based approach to foster socio-economic development and peace building in rural communities in northern Uganda.
BSF Thema	Database of activity sheets for mediation actions
Code for Senegal	A community of volunteers who work voluntarily to develop digital solutions to solve social problems.
Common Voice Kinyarwanda	The common is an open speech database that should allow anyone to develop speech recognition solutions in Kinyarwanda.
Community Exchange Systems Ltd	The Community Exchange System (CES) is a web service that provides the tools for communities to set up and manage exchanges and trade in their area without using money. It also provides communities with a network that allows them to exchange.
Data Transport	Data Transport is a non-profit organization working to improve African mobility through transport data. It provides a concrete response by developing tools and methodologies adapted to the African context to make transport data available.
DigitalTransport4Africa	Provision of standardized and open urban mobility data for African cities.
echOpen Foundation	The echOpen Foundation is an open and collaborative project bringing together an international community of multidisciplinary experts and professionals around a common goal: to make medical imaging accessible worldwide.

Emmabuntüs	The Emmabuntüs collective is an informal group of people who formed around a project based on the use of a Linux distribution named Emmabuntüs developed to simplify the reconditioning of used computers given to humanitarian associations, in particular to Emmaus communities (hence its name) and to promote the discovery of Linux by beginners, but also to extend the use of Linux to other users.
Energypedia	Sharing knowledge for renewable energy deployment
Ethnos Project	The Ethnos Project is a research initiative and resource database that explores the intersection between Indigenousness and information and communication technologies (ICTs).
FairCoin	FairCoin is a digital currency powered by a cooperative grassroots movement. It is a global, stable and democratic currency.
FLOSS Manuals	A community that creates great, flexible, easy-to-use manuals together. FLOSS Manuals creates booklets, course materials and manuals for creative, cultural and activist uses of free software.
GBIF	The Global Biodiversity Information Facility (GBIF) is an international network and data infrastructure funded by the world's governments to provide open access to data on all life on Earth for everyone, everywhere.
Gitcoin	Gitcoin is a platform where you get paid to work on open source software in Python, Rust, Ruby, JavaScript, Solidity, HTML, CSS, Design, and more.
Global Open Facility Registry (GOFR)	IntraHealth is developing a set of software tools that will identify and synthesize duplicate health facility records across multiple data sources for the Global Open Facility Registry (GOFR) Core project.

Grain Library	Plant and animal seed bank based in Côte d'Ivoire
Green Alert	#GreenAlert helps you find out what environmental impact assessments (EIAs) are underway in your area. Find your location to see the details of an EIA: its official identifier, project description, development status, and the government agency responsible for permitting and controlling the development. You can keep up to date on the status of EIAs that interest you by registering
Hand-in-Hand geospatial data platform	The platform is part of FAO's Hand-in-Hand initiative - an evidence-based, country-led and country-controlled initiative to accelerate agricultural transformation and sustainable rural development to eradicate poverty (SDG1) and end hunger and all forms of malnutrition (SDG2), including through the use of the most sophisticated tools available, such as advanced geospatial modeling and analysis
HarassMap	Build a society that ensures the safety of all people from sexual and gender-based violence.
Open COVID19 initiatives Senegal	A digital initiative, based on free tools to help and accompany populations in the fight against this health crisis.
IWACU Open Data	IWACU Open Data, initiated and developed by the IWACU press group, aims to provide open and reusable data about Burundi, and to centralize all valid data about Burundi. It is a working tool for journalists (fact-checking and development of datajournalism projects), as well as a tool for citizens, researchers, NGOs and policy makers.
Junebug	Junebug is a unified messaging gateway that connects governments, NGOs, enterprises and aggregators to local mobile network infrastructure, enabling them to send and receive millions of mobile messages faster and more efficiently than ever before.

Kiwix	Wherever you go, you can browse Wikipedia, read books from the Gutenberg Library or watch TED talks and more, even if you don't have an Internet connection. Kiwix is a non-profit organization. All code is free and open-source.
Laws.Africa	Laws.Africa's mission is to enable African governments to sustainably provide free access to trusted digital laws in a user-friendly, accessible, educational and reusable manner. Laws.Africa empowers individuals, communities, governments, businesses and innovators to support our vision of an Africa of good governance, democracy, respect for human rights, justice and the rule of law.
Linguere Fablab	Learning and incubation space Linguere Fablab accompanies women in digital transformation 1st Senegalese Fablab run by women and for women
Schoolbooks.com	A field textbook, produced collaboratively by teachers and available for free access on the internet
Local Open GovLab	local governance institutions
LowTechLab	The Low-tech Lab is an open-source research and documentation program that aims to enhance low-tech innovation while boosting its development.
Masakhane	A bottom-up community around natural language processing for Africa, by Africans
Mojaloop	Mojaloop's mission is to increase financial inclusion by empowering organizations to create interoperable payment systems to enable digital financial services for all.

Molo	Molo is more than a content management system. It is a powerful tool that allows organizations to create, publish and manage content on the web in a way that makes it accessible to millions of people, especially those living in low-bandwidth, resource-poor environments where the cost of data is still a significant barrier.
MomConnect Platform	Praekelt.org's MomConnect platform is a suite of mobile technologies, tools, and methodologies that enable governments and other implementing partners to create and manage personalized health programs at the population level. In operation in South Africa for nearly two years, the platform supports programs that are about to launch in Nigeria and Uganda.
My Human Kit	The association My Human Kit invents, manufactures and shares technical aid solutions for and with people with disabilities.
Nubian VR	NubianVR is a technology company focused on improving the way we learn by creating immersive virtual and augmented reality learning experiences and making them easily accessible to everyone.
OLIP (Offline Internet Platform)	Access to digital content and applications in areas with little or no disconnection
Open CRVS	OpenCRVS fills the current market gap in user-centered, rights-based CRVS by leading the development of OpenCRVS, a free, open-source digital CRVS solution that is adaptable to the national context, interoperable with other government systems (e.g., health and identification systems), and rights-based to ensure the protection and care of the most vulnerable people.
Open Djeliba	Participatory information platform by SMS.
Open Food Facts	Open Food Facts collects information and data on food products from around the world.

Open Food Network	The Open Food Network is a global network of people and organizations working together to build a new food system. Together, we are developing open and shared resources, knowledge and software to support a better food system.
Open Robotics	OSRF's initial mission is to support the development, distribution, and adoption of open source software for use in research, education, and robotics product development. We aim to be the hub of the global robotics community. To this end, we create open software and hardware platforms for robotics, and use these platforms to solve important problems and help others do the same.
Open Schools Kenya	People can collect information about their communities themselves and share it openly online. This is a new way of collecting and sharing information, not based on formal surveys but on people's local knowledge. Citizen data is public data, shared openly.
Open Source Ecology	Open Source Ecology (OSE) is a network of farmers, engineers, architects, and supporters, whose primary goal is the eventual manufacture of the Global Village Construction Set (GVCS). As Open Source Ecology describes it, "the GVCS is an open technology platform that makes it easy to manufacture the 50 types of industrial machinery needed to build a small civilization.
Open Source Medical Supplies (OSMS)	Launched in March 2020, Open Source Medical Supplies (OSMS) has brought together a global network of more than 74,000 manufacturers, builders, community organizers, and healthcare professionals who are working to address the unprecedented medical supply challenges resulting from the COVID-19 pandemic.
Open-Sankoré	Open-Sankoré is a free and open source interactive whiteboard software (IWB) compatible with any projector with a pointing device (board, tablet, infrared sensor, mobile board, interactive video projector or VPI...).

openAFRICA	openAFRICA aims to be the largest independent open data repository on the African continent. openAFRICA is not a government portal. Rather, it is a grassroots initiative, maintained by Code for Africa, as a public service. The platform is available as a free resource for ordinary citizens, civil society organizations, civic activists, media, and government agencies.
OpenHMIS	An open source hospital management information system based on OpenMRS.
OpenSRP	OpenSRP is an open source platform, which allows governments and technology partners to easily adapt content and functionality to the needs of health workers. OpenSRP has a modular design, making it easy to include existing modules, content and functionality needed for each context. OpenSRP is interoperable with other leading open source health information tools in widespread use today.
OpenStreetMap	OpenStreetMap (OSM) is a collaborative online mapping project that aims to build a free geographic database of the world (e.g., allowing the creation of open source maps), using GPS and other open data.
OpenUp	We create tools, open data, and provide data training that promote active citizenship and help communities and governments work better, together.
PamojaNET	Pamoja, "together" in Swahili, is an initiative of Ensemble that began in 2016 to install the island's first Wifi network, Pamoja Net.
Precious Plastic	Precious Plastic is a combination of people, machines, platforms and knowledge to create an alternative global recycling system.
Project Gutenberg	Project Gutenberg is an online library of free e-books.
Public Lab	Pursue environmental justice through community science and open technology.

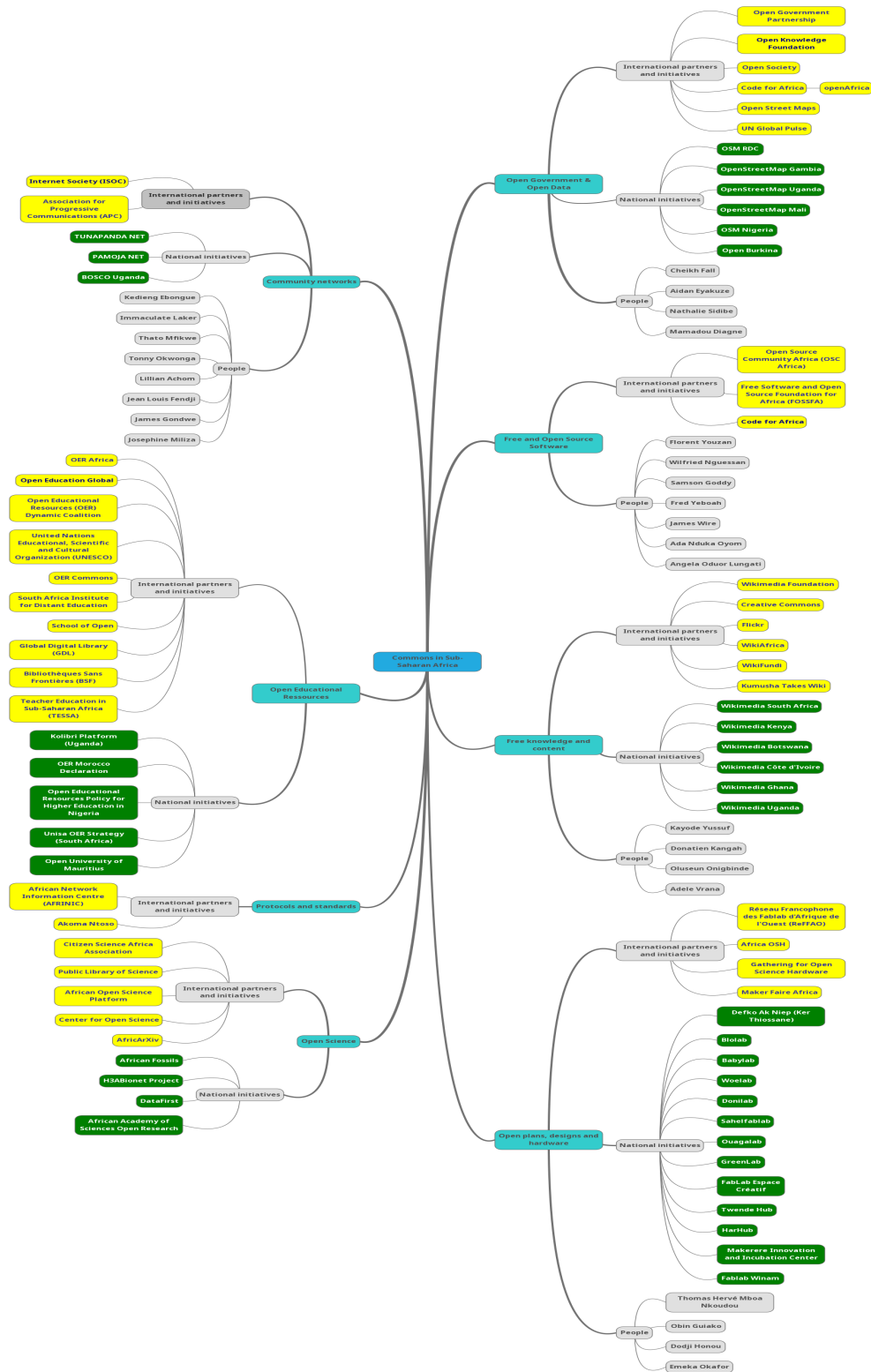
Raspberry Pi	From small businesses to large corporations, from the kitchen table tinkerer to the classroom coder, Raspberry Pi makes computing accessible and affordable for everyone.
SatNOGS	The SatNOGS (Satellite Networked Open Ground Station) project is a set of software and hardware to create a network of open source ground stations
Senegal Open	Publication of open data on Senegal
SEOSAW	SEOSAW comprises a network of scientists and a network of woodland study plots in Africa. The long-term goal of SEOSAW is to understand the response of African forests to global change. SEOSAW members conduct diverse research, but are united by a common interest in forest and savanna ecology.
SmartElect	First open source election platform with mobile at the heart of the system
SORMAS	SORMAS (Surveillance Outbreak Response Management & Analysis System) is the digital solution for mHealth and eHealth surveillance of outbreaks worldwide. It covers infectious diseases from COVID-19 to Ebola and provides a digital infrastructure for timely management and control measures to verify disease cases.
Trufi	We help transform mobility in cities with open source applications, and open data solutions that enable innovation.
TunapandaNET	TunapandaNET is a low-cost community wireless network supported by Tunapanda Institute, whose goal is to create a digital ecosystem in education, health, and business by enabling community members to leverage connectivity for socio-economic empowerment. Our mission is to promote internet access for all by investing in low-income areas through the provision of infrastructure and network capacity.

UCT Knowledge Co-Op	For many years, University of Cape Town (UCT) staff and students have worked in partnership with communities to address development challenges. The UCT Knowledge Co-op builds on this tradition of social responsiveness and aims to facilitate community partners' access to UCT's skills, resources and professional expertise.
Ushahidi	Crowdsourcing solutions to strengthen communities We create technologies that help people gather, map and analyze information to build a better world.
VideoLAN	VideoLAN develops and distributes cross-platform software, several audio/video codecs and libraries for free under the GPL. VideoLAN's best known project is the VLC media player.
WAZIUP Open Source IoT and Cloud platform	The vision of WAZIHUB is to harness the potential of IoT and best practices in Big-Data technologies through the participation of innovators. The project aims to enable the creation of a network of open hubs across Africa where: 1. Entrepreneurs and developers can be trained 2. Innovative IoT technology solutions can be adapted 3. New businesses can grow to meet local service needs.
WeFarm	Wefarm has become an independent, mission-driven company building a trusted digital platform that enables a global community of small farmers to be more successful. To date, 2.4 million farmers have connected with each other for free and without internet access via Wefarm's SMS platform.
Wiki Kouman	The Wiki Kouman project aims to increase the visibility and content of the languages of the Ivory Coast via the Wiktionary and other related projects. Wiki Kouman derives its etymology from Dioula, one of the local languages, in which "Kouman" means "to speak".
WikiFundi	Editing a wiki in offline mode

Wikimedia Community User Group Ivory Coast	WCUG-CI supports the goals pursued by the Wikimedia Foundation, including the work of volunteer contributors on Wikimedia projects as well as the many other free knowledge initiatives. WCUG-CI aims to encourage the growth, development and dissemination of educational content in various languages and to make it fully available to the public, without payment.
WikiSigns	WikiSigns is an open access, open content sign language dictionary on the Internet, supported and hosted by the non-profit Wikisigns Foundation.
Wikiversity	Wikiversity is a community project aiming to disseminate educational documents (courses, exercises, tutorials, practical work, MOOCs...) free of charge, without advertising and without using the personal data of its users.
Zenzeleni Networks	Provide affordable communications to marginalized/unconnected communities in South Africa.

Appendix 2 - Mapping of key players

The mapping can be viewed and downloaded online under the following link:
<https://app.mindmup.com/map/free/2022/07/a7ec8150fa3811ecaba0592242f6d5cd>



Appendix 3 - List of persons interviewed

Alexis Kauffmann, Direction du numérique pour l'éducation
Balthas Seibold, Lea Gimpel & Daniel Brummund, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
Benjamin Jean, Inno3
Cecilia Hinga, Rhoda Omenya & Declan Ottaro, Ushahidi
Christian Ambaud, Organisation Internationale de la Francophonie (OIF)
Donatien Kangah, Wikimedia User Group Côte d'Ivoire
Dorcas Wephekulu, African Storybook
Fifii Baidoo, WaziHub
Florent Youzan, Axian Group
Frédéric Sultan, Remix The Commons
Heath Arensen, Digital Impact Alliance
Jacopo Ottaviani, Code for Africa
Jennifer Antilla, Open MRS
Jo Havemann & Johanssen Obanda, AfricArXiv
Kayode Yussuf, Wikimedia Nigeria User Group
Lisa Feldmann, Energypedia
Lucy Harris, Digital Public Goods Alliance
Malou Charenton, FabMob
Mamadou Diagne, Linux Sénégal
Musa Stephen Honule, AFRINIC
Nathalie Sidibe, OpenStreetMap Mali
Obin Guiako, Babylab
Patrick Byamungu & Heri Cihimba, La Différence
Seth Blum & Jennifer Pratt Miles, Lacuna Fund
Shaila Aga & Will Ruddick, Grassroots Economics
Valérie Peugeot, Orange Labs
Zahir Hussein Shaukatoli, Tanzania Open Innovation Organization